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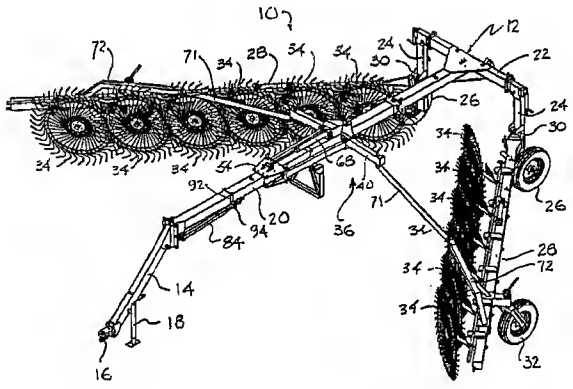
(54) RATEAU A FOIN PLIANT
(54) FOLDING HAY RAKE

(57)

An agricultural implement such as a folding rake has a main frame and two secondary frames pivotally mounted on opposite sides of the main frame for pivotal movement between a transport position extending along respective sides of the main frame and a field position diverging from the respective sides of the main frame. A folding mechanism for moving the secondary frames between their transport and field positions includes two fold arms pivotally mounted on the main frame and two connection braces pivotally connected to the respective secondary frames and the fold arms. The fold mechanism includes a fold actuator for pivoting the fold arms about the fixed pivot to move the secondary frames between the transport and the field positions. The preferred fold actuator includes a slide mounted on the main frame of the implement, links connecting the slide to the fold arms and an hydraulic cylinder mounted on the main frame for moving the slide along the main frame. The arms isolate the fold actuator from forces acting on the secondary frame, mitigating the potential for cylinder creep. The implement can be used with only one of the secondary frames deployed by disconnecting one of the links from the slide.



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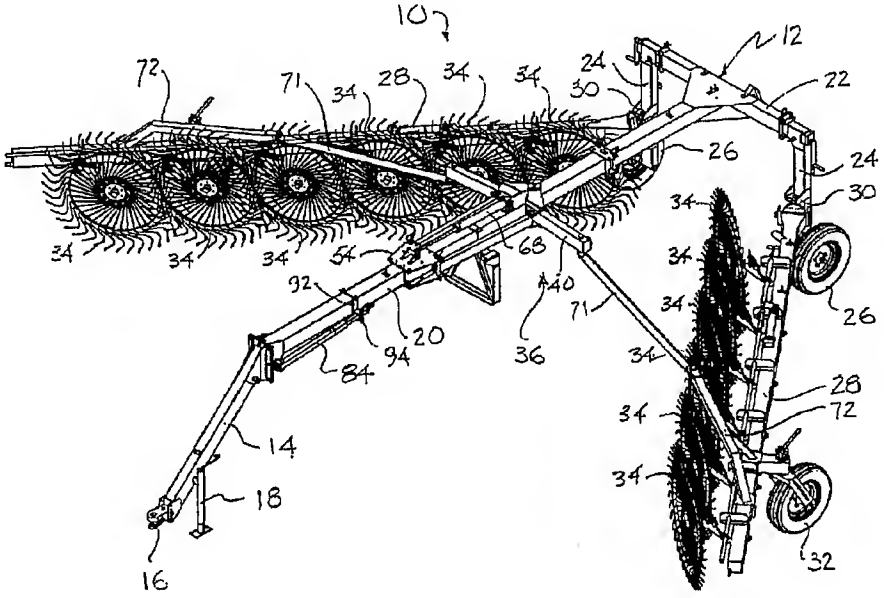
(54) Titre : RATEAU A FOIN PLIANT
(54) Title: FOLDING HAY RAKE



(57) Abrégé/Abstract:
An agricultural implement such as a folding rake has a main frame and two secondary frames pivotally mounted on opposite sides of the main frame for pivotal movement between a transport position extending along respective sides of the main frame and a field position diverging from the respective sides of the main frame. A folding mechanism for moving the secondary frames between their transport and field positions includes two fold arms pivotally mounted on the main frame and two connection braces pivotally connected to the respective secondary frames and the fold arms. The fold mechanism includes a fold actuator for pivoting the fold arms about the fixed pivot to move the secondary frames between the transport and the field positions. The preferred fold actuator includes a slide mounted on the main frame of the implement, links connecting the slide to the fold arms and an hydraulic cylinder mounted on the main frame for moving the slide along the main frame. The arms isolate the fold actuator from forces acting on the secondary frame, mitigating the potential for cylinder creep. The implement can be used with only one of the secondary frames deployed by disconnecting one of the links from the slide.

ABSTRACT

An agricultural implement such as a folding rake has a main frame and two secondary frames pivotally mounted on opposite sides of the main frame for pivotal movement between a transport position extending along respective sides of the main frame and a field position diverging from the respective sides of the main frame. A folding mechanism for moving the secondary frames between their transport and field positions includes two fold arms pivotally mounted on the main frame and two connection braces pivotally connected to the respective secondary frames and the fold arms. The fold mechanism includes a fold actuator for pivoting the fold arms about the fixed pivot to move the secondary frames between the transport and the field positions. The preferred fold actuator includes a slide mounted on the main frame of the implement, links connecting the slide to the fold arms and an hydraulic cylinder mounted on the main frame for moving the slide along the main frame. The arms isolate the fold actuator from forces acting on the secondary frame, mitigating the potential for cylinder creep. The implement can be used with only one of the secondary frames deployed by disconnecting one of the links from the slide.

FOLDING HAY RAKE

FIELD OF THE INVENTION

The present invention relates to agricultural implements and has particular relation to a folding mechanism for an agricultural implement.

BACKGROUND

Certain agricultural implements have a primary frame and folding secondary frames. These include, for example, wheel rakes for gathering cut forage into a windrow. The windrowed crop can then be baled or harvested in some other way. With the development of high capacity balers, it is beneficial to be able to gather two or more swaths or windrows into one windrow in order to save baling time. The use of wide rakes reduces the time required to both rake and bale a field.

The construction of wide rakes requires a convenient mechanism for folding the rakes for transportation.

The folding mechanisms proposed in the past include the use of two double-acting cylinders directly connecting the main frame with the secondary rake wheel mounting frames as disclosed in Menichetti United States patent 5,685,135. Another known system uses two stretcher arms pivotally connected to the rake wheel mounting frames and to a common slide mounted on the main frame, with a single cylinder for moving the slide. A system of this sort is disclosed in Peeters United States patent 5,598,691.

These known prior art systems suffer from certain disadvantages. With a double cylinder arrangement, the cylinders are long and expensive and an additional mechanism must be provided to ensure that the cylinders extend and retract uniformly and maintain uniform positions. In this system, the cylinders are used as structural components in tension when the rake is in the open, field position. If the rake is to be used at a partially opened position, cylinder creep can be expected.

With the single cylinder and slide arrangement, the cylinder is shorter but still relatively long. In use it is under compression so that In a partially open position, cylinder creep can be expected.

The present invention aims at the provision of novel features in a folding implement of this type.

SUMMARY

According to the present invention there is provided an agricultural implement comprising:

an elongate main frame with a leading end and trailing end;

two secondary frames pivotally mounted on opposite sides of the main frame for pivotal movement of each secondary frame between a transport position extending along a respective side of the main frame and a field position diverging from the respective side of the main frame in a direction from the trailing end to the leading end;

a folding mechanism for moving the secondary frames between their transport and field positions, the folding mechanism comprising:

two fold arms;

fixed pivot means pivotally mounting the two fold arms on the main frame;

two connection braces pivotally connected to the respective secondary frames;

brace pivots pivotally connecting the connection braces to respective ones of the fold arms at positions spaced from the fixed pivot means; and

fold actuating means for pivoting the fold arms about the fixed pivot means for moving the secondary frames between the transport and the field positions.

Each fold arm acts as a lever turning on the fixed pivot connection to the main frame. In the position of maximum secondary frame divergence, the pivot points for the fold arm and the connection brace are aligned, and no moment is applied to the fold arm from drag forces on the secondary frame. This means that the fold actuator is not a primary structural member taking large loads in the field position. Even in a partially open condition, the loads are quite small, mitigating the potential for cylinder creep where the actuator is an hydraulic cylinder. Appropriate selection of the fold arm geometry limits the necessary travel of the actuator, so that a relatively short stroke cylinder can be used.

In a preferred embodiment of the present invention, the fold actuating means include a slide mounted on the main frame of the implement and links connecting the slide to the fold arms between the fixed pivot means and the braces. The fold actuating means also preferably include an hydraulic cylinder mounted on the main frame for moving the slide along the main frame. The implement can be used with only one of the secondary frames deployed by disconnecting one of the links from the slide. The disconnected link may be connected to the main frame.

In preferred embodiments of the implement, the main frame has an elongate main beam and a cross beam at the trailing end of the main beam. The secondary frames are pivotally mounted on the cross beam on opposite sides of the tongue. The cross member is supported on ground wheels and has an adjustable length to adjust the overall width of the implement between the secondary frames.

The implementation of these characteristics and other preferred or optional features will be described in the following in connection with an exemplary embodiment of a rake. It is to be understood that other embodiments, including other types of implement are possible.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, which illustrate an exemplary embodiment of the present invention:

Figure 1 is an isometric view of a rake in a deployed, field position;

Figure 2 is an isometric view of the rake of Figure 1 in a transport position;

Figure 3 is an isometric view of the rake with only one side deployed;

Figure 4 is a plan view of the rake in the field position;

Figure 5 is a plan view of the rake in the transport position;

Figure 6 is a plan view of the rake with one rake arm deployed;

Figure 7 is a side elevation of the rake in the transport position;

Figure 8 is a trailing end elevation of the rake in the transport position;

Figure 9 is an isometric detail of the folding mechanism;

Figure 10 is a plan view of the folding mechanism;

Figure 11 is an isometric like Figure 9 showing one side of the folding mechanism deployed and the other disconnected;

Figure 12 is a plan view of the folding mechanism with one side deployed and the other disconnected;

Figure 13 is a trailing end elevation of the implement partially broken away to show the width adjustment mechanism; and

Figure 14 is an isometric detail of the rake wheel raising and lowering mechanism.

DETAILED DESCRIPTION

Referring to the accompanying drawings, there is illustrated an agricultural implement in the form of a wheel rake 10 with a T-shaped main frame 12. At the leading end of the main frame is a hitch pole 14 carrying a clevis type hitch 16

and a support jack 18. The hitch pole 14 projects forwardly from the main beam 20 of the frame 12.

The main beam 20 extends longitudinally of the implement to a trailing end where it is connected to a cross beam 22. An upright leg 24 at each end of the cross beam carries a ground wheel 26. Two secondary frames in the form of rake arms 28 are mounted on the respective legs 24 by double axis joints 30 that allow the rake arms 28 to pivot laterally between the deployed state illustrated in Figure 1 and the transport position illustrated in Figure 2 and also vertically to accommodate variations in ground level. So that each rake arm may follow the ground contours, it is equipped with a caster wheel 32 partway along the arm.

Each rake arm is equipped with six rake wheels 34. The mounting of these wheels will be described in more detail in the following.

To effect the movement of the rake arms 28 between the deployed, field position illustrated in Figure 1 and the transport position illustrated in Figure 2, the rake implement is provided with a fold mechanism 36 that is illustrated most particularly in Figures 9 through 12. The fold mechanism includes two fold arms 40 mounted on the main beam 20 of the main frame by a fixed pivot 42. The inner section 44 of each fold arm is bifurcated to extend across the top and bottom of the main beam for connection to the pivot. The outer section 46 of the fold arm projects from the outer end of the inner section at an obtuse angle. At its outer end each fold arm it carries a pivot connection 48.

Between the fixed pivot 42 and the pivot connection 48 is an intermediate pivot 50 connected to a fold link 52. The link 52 extends from the fold arm to a slide 54 that is mounted slidably on the main beam 20 of the main frame between the fixed pivot 42 and the leading end of the main frame. The slide is composed of two side channels 56 on opposite sides of the main beam, a top plate 58

and a bottom plate 60 respectively above and below the main beam. The top and bottom plates 58 and 60 are trapezoidal and project beyond the main beam to provide ears through which holding pins 62 may be inserted to couple the ends of the fold links 52 to the slide. On the top of the slide are two lugs 64 that are used to provide a coupling to the piston rod 66 of an hydraulic fold cylinder 68. The cylinder extends along the main beam 20 and is connected to a cylinder mounting bracket 70 between the slide and the fixed pivot 42.

The pivot connections 48 on the ends of the fold arms 40 are connected to braces 71 that extend from the fold arms to brace mounts 72 (Figures 1, 4 and 7) mounted on respective ones of the rake arms 28 to which they are connected by pivot connections 73. The brace mounts project upwardly and towards the trailing end from the respective rake arms to clear the rake wheels in a raised, transport position of the wheels.

To unfold the rake frame from the transport position (Figures 2 and 5) to the field position (Figures 1 and 4), the fold cylinder 68 is actuated to push the slide 54 forwardly along the main beam 20. This pulls on the fold links 52, rotating the fold arms 40 about the fixed pivot 42. This pushes the inner ends of the braces 71 outwardly and forwardly, forcing the rake arms 28 outwardly to the field position. As can be seen most readily from Figure 4, in the position of maximum extension of the rake arms, the fixed pivot 42, the pivot connection 48 and the pivot connection 73 between the brace and the brace mount are aligned so that any forces acting on the rake arm and through the brace will have a line of action through the fixed pivot or very close to it. Consequently, no moment is applied to the fold arm and there is no tension on the fold link and no compressive force on the fold cylinder. In practice, the alignment may not be perfect but the forces transmitted to the cylinder are minimal and the danger of cylinder creep is likewise minimized. Where the rake is only

partially deployed, larger forces will be exerted on the cylinder, but these are again limited by the geometry of the fold mechanism.

The rake can be used with only one side deployed as illustrated in Figures 3 and 6. The disposition of the fold mechanism to achieve this is illustrated in Figures 11 and 12. The folding pin 62 for the side of the implement that is to remain folded is disconnected from the slide 54. This frees the associated link 52 from the slide so that when the cylinder is extended, only the other side of the implement will be unfolded to the field position. A fold arm retainer 74 mounted on the main beam behind the fixed pivot 42 carries a pair of lock pins 76, one on each side. When one side is to be disconnected, the lock pin is passed through lock apertures in the retainer and through a fold arm lock sleeve 78 (Figures 9 and 10) mounted on the outer end of the lock sleeve and which aligns with the lock holes in the retainer in the folded condition of the fold arm.

A link guide bracket 80 is mounted on the main beam. It extends laterally to both sides of the main beam under the fold links 52. It has apertures 82 that, in the folded condition of the implement shown in Figure 5, are beside the folding pins 62 connecting the slide and the fold links. A disconnected fold link can then be swung outwardly and pinned to the guide bracket 80 using the link pin 62. This, along with the fold arm retainer and lock pin 74 and 76, secures the non-active side of the rake against inadvertent unfolding.

At the leading end of the main frame are two transport locks 84. These are connected to the main beam 20 by joints that pivot about a horizontal axis transverse to the main beam and a perpendicular second axis. The transport locks extend from the main beam to the front ends of the rake arms in the transport position where the locks are connected to studs on the rake arms. In the field position, the transport locks are rotated and pivoted to positions extending along the main beam

and held in place using brackets 92 on the main beam and pins 94.

As illustrated most particularly in Figure 13, the cross beam 22 of the main frame is a composite beam with an outer tube 96 connected across the end of the main beam 20 and two inner tubes 98 engaged telescopically in the ends of the outer tube. The inner tubes carry the legs 24. At the center of the outer tube 96 is a vertical cross plate 100 carrying two nuts 102. Threaded into these nuts are two crank rods 104, which extend to opposite ends of the cross beam, where each is supported in a bracket 106. Two collars 108 pinned to the crank rod prevent relative movement of the inner tube along the crank rod. A crank 110 is mounted on the outer end of each crank rod. At the ends of the outer tube 96 are clamps 112 that serve to clamp the respective inner tubes 98 in place with respect to the outer tube.

This mechanism may be used for adjusting the length of the cross beam and therefore the width of the rake. The clamps 112 may be released and the cranks 110 operated to move the inner tubes 98 in and out of the outer tube to a desired adjusted width and then the clamps are re-engaged.

Figure 14 illustrates the rake wheel mounting and lifting mechanism. For each rake wheel 34 there is a rake wheel arm 114 that carries a transverse shaft 116 at the leading end. The shaft is engaged in a sleeve 118 mounted on the underside of the rake arm. At the opposite, trailing end of the arm 114 is a hub 120 for mounting the respective rake wheel.

An arm 122 projects upwardly from each rake wheel arm 114. This is connected to a spring 124 and to a chain 126 that extend from the arm, in parallel with the spring, to limit the spring extension. The chain goes beyond the spring to a collar 128 mounted on a control rod 130 extending along the rake arm. The control rod is supported on the rake arm by a series of control rod brackets 132. The rear end of the control rod 130 carries a stroke control bolt 134 that may be adjusted

longitudinally with respect to the control rod. The stroke control bolt confronts a stop brake 136 on the rake arm to limit the travel of the control rod towards the trailing end of the rake arm.

Longitudinal movement of the control rod is caused by a double acting lift cylinder 140 mounted on the rake arm by a cylinder mounting bracket 142. The piston rod of this cylinder is connected to a bracket 144 on the control rod. When extended, the cylinder moves the control rod towards the trailing end of the rake arm and lowers the rake wheels to the extent permitted by the engagement of the stroke control bolt with the bracket 136. The opposite movement of the cylinder draws the control rod to the leading end and raises the rake wheels off the ground for transport purposes.

The use of a double acting cylinder in the wheel lifting mechanism provides a positive positioning of the rake control rod. With a single acting cylinder and a spring return, significant delays and sluggish movement can be experienced when lowering the wheels to their working positions

While one embodiment of the present invention has been described in the foregoing, it is to be understood that other embodiments are possible within the scope of the invention. For example, the single cylinder and slide arrangement can be replaced with two cylinders acting directly on the fold arms. With this arrangement, each side of the rake could be moved independently of the other when connected to separate hydraulic circuits on the tractor. Some advantages may be gained with this arrangement under some field conditions. If the two cylinder arrangement is to be used with a single hydraulic circuit, some means would be required to ensure that the two sides open uniformly. This could be done either mechanically or hydraulically.

In view of the numerous changes and modifications that could be made within the scope of the invention, the invention is not to be considered limited by the

foregoing description, but solely by the scope of the appended claims.

CLAIMS

1. An agricultural implement comprising:

an elongate main frame with a leading end and trailing end;

two secondary frames pivotally mounted on opposite sides of the main frame for pivotal movement of each secondary frame between a transport position extending along a respective side of the main frame and a field position diverging from the respective side of the main frame in a direction from the trailing end to the leading end;

a folding mechanism for moving the secondary frames between their transport and field positions, the folding mechanism comprising:

two fold arms;

fixed pivot means pivotally mounting the two fold arms on the main frame;

two connection braces pivotally connected to the respective secondary frames;

brace pivots pivotally connecting the connection braces to respective ones of the fold arms at positions spaced from the fixed pivot means; and

fold actuating means for pivoting the fold arms about the fixed pivot means for moving the secondary frames between the transport and the field positions.

2. An implement according to Claim 1 wherein the fold actuating means comprise a slide mounted on the main frame for sliding movement therealong and links connecting the slide to the fold arms.

3. An implement according to Claim 2 wherein the links are pivotally connected to the fold arms between the fixed pivot means and the brace pivots.

4. An implement according to Claim 1, 2 or 3 wherein the fold actuating

means comprise an hydraulic cylinder mounted on the main frame.

5. An implement according to Claim 2 or 3 wherein the fold actuating means comprise an hydraulic cylinder mounted on the main frame and connected to the slide for moving the slide along the main frame.

6. An implement according to Claim 2, 3 or 4 including means for selectively disconnecting at least one of the links from the slide.

7. An implement according to Claim 2, 3 or 5 including means for selectively disconnecting at least one of the links from the slide and coupling each disconnected link to the main frame.

8. An implement according to any one of Claims 1 through 7 wherein the main frame comprises an elongate main beam and a cross beam extending transversely across the main beam at a trailing end of the main beam, the secondary frame being pivotally mounted on the cross member on opposite sides of the tongue.

9. An implement according to Claim 8 including ground wheels mounted on the cross member adjacent its opposite ends.

10. An implement according to Claim 8 or 9 including means for adjusting the length of the cross member between the secondary frames.

11. An implement according to any one of Claims 1 through 10 where the implement is an agricultural rake, each of the secondary frames being a rake arm, and including a plurality of rake wheels mounted on each of the rake arms.

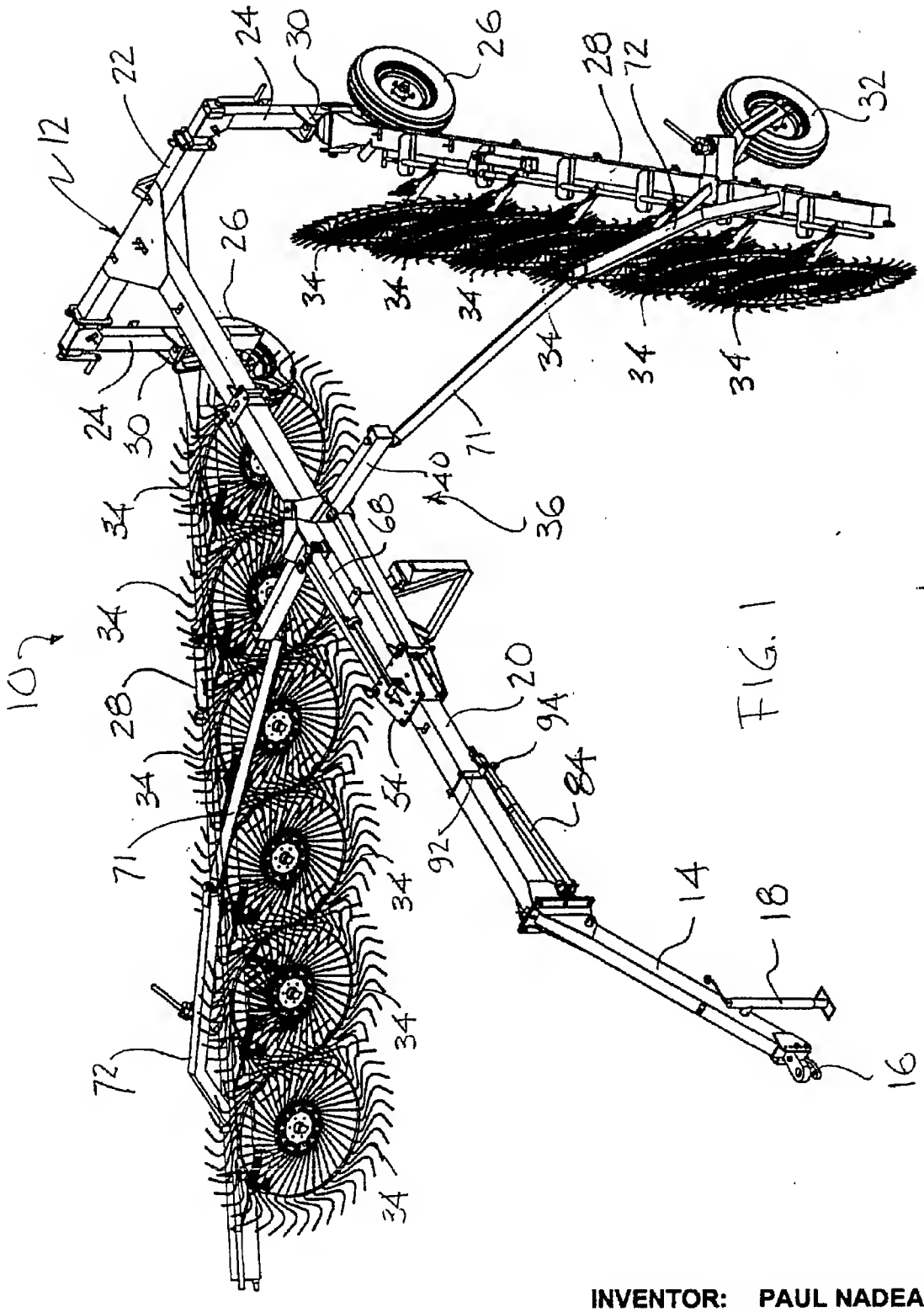


FIG. 1

INVENTOR: PAUL NADEAU
By: *ADE & COMPANY*

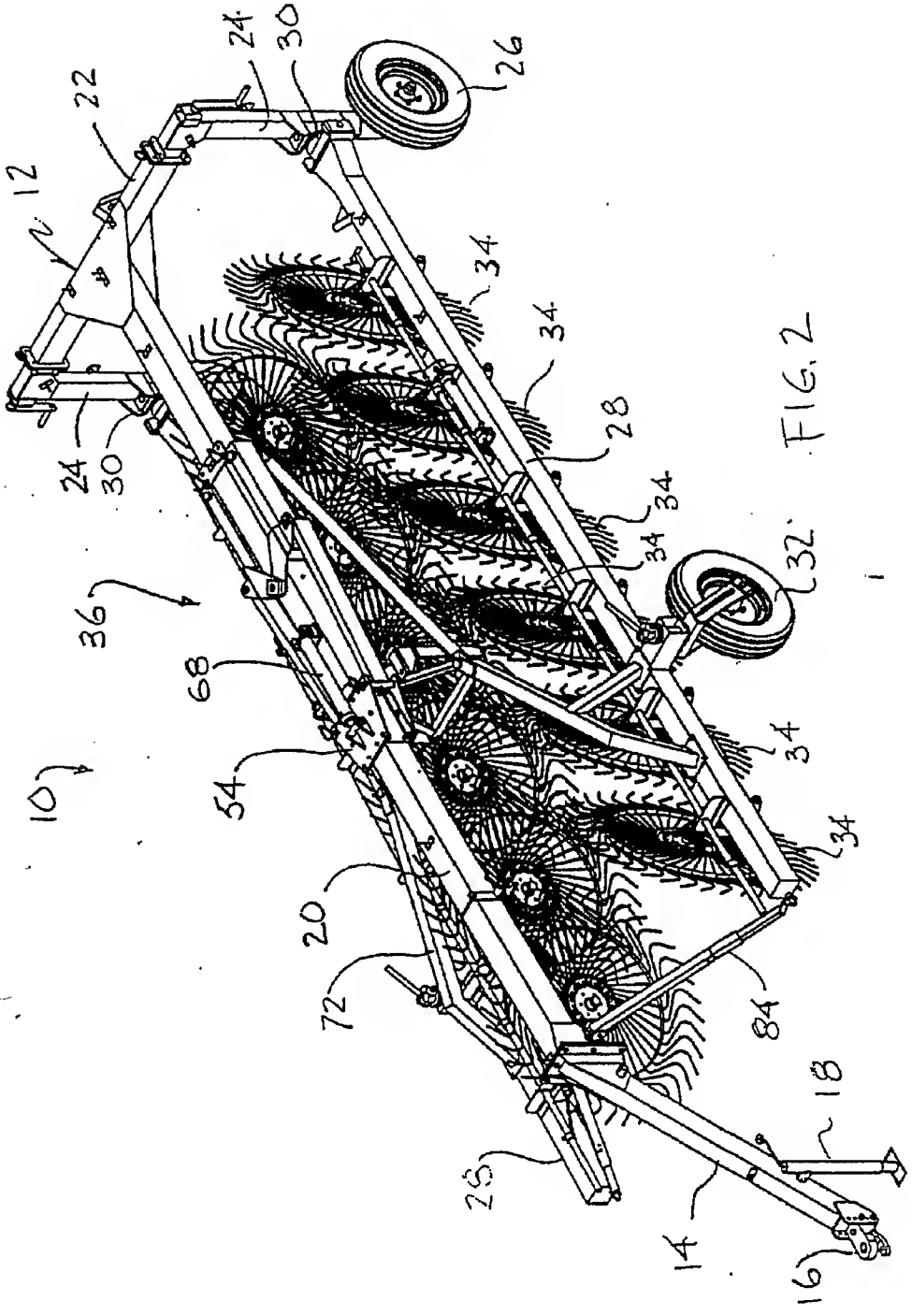


FIG. 2

INVENTOR: PAUL NADEAU
By: *ADE & COMPANY*

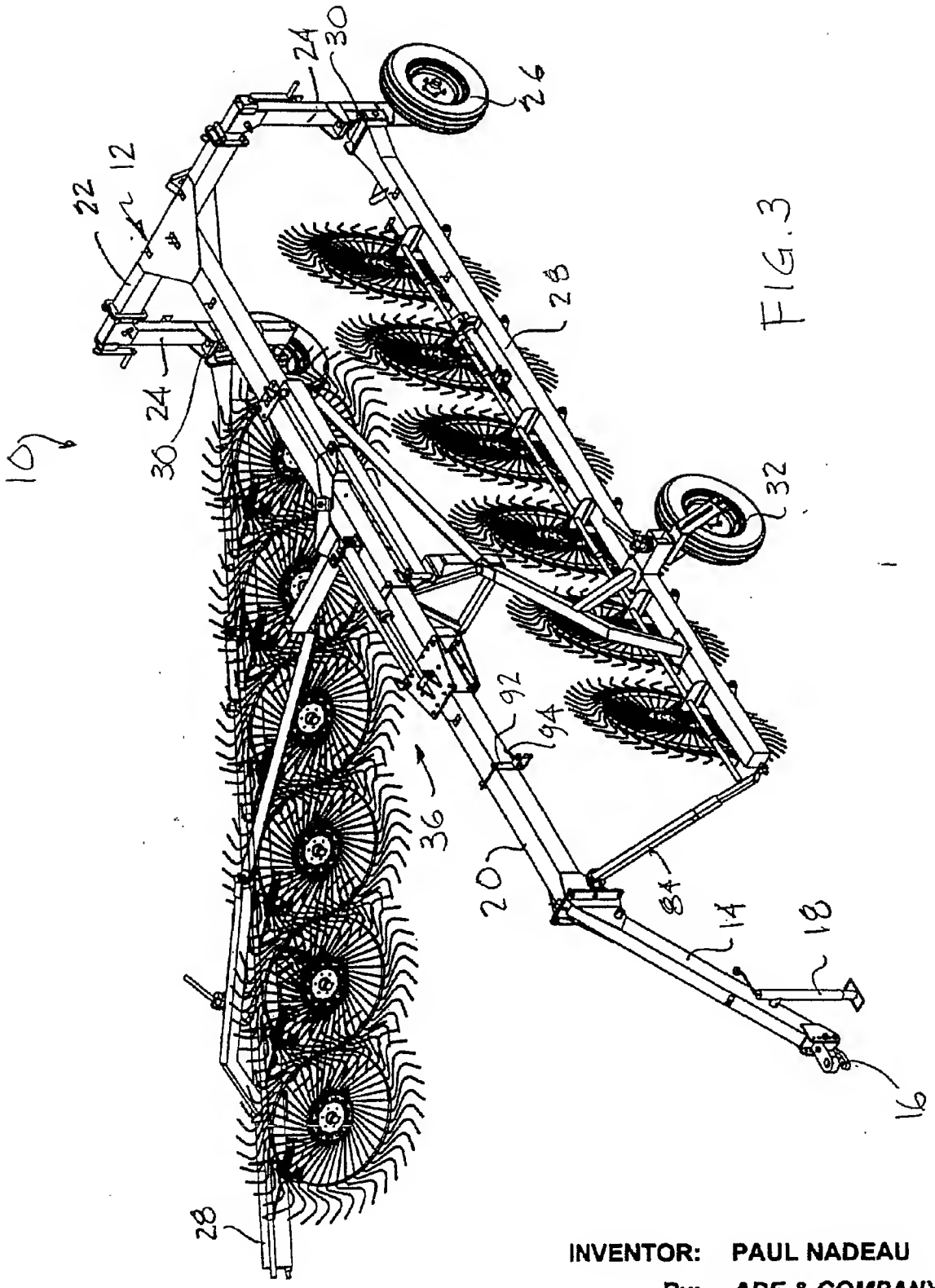


FIG. 3

INVENTOR: PAUL NADEAU
By: *ADE & COMPANY*

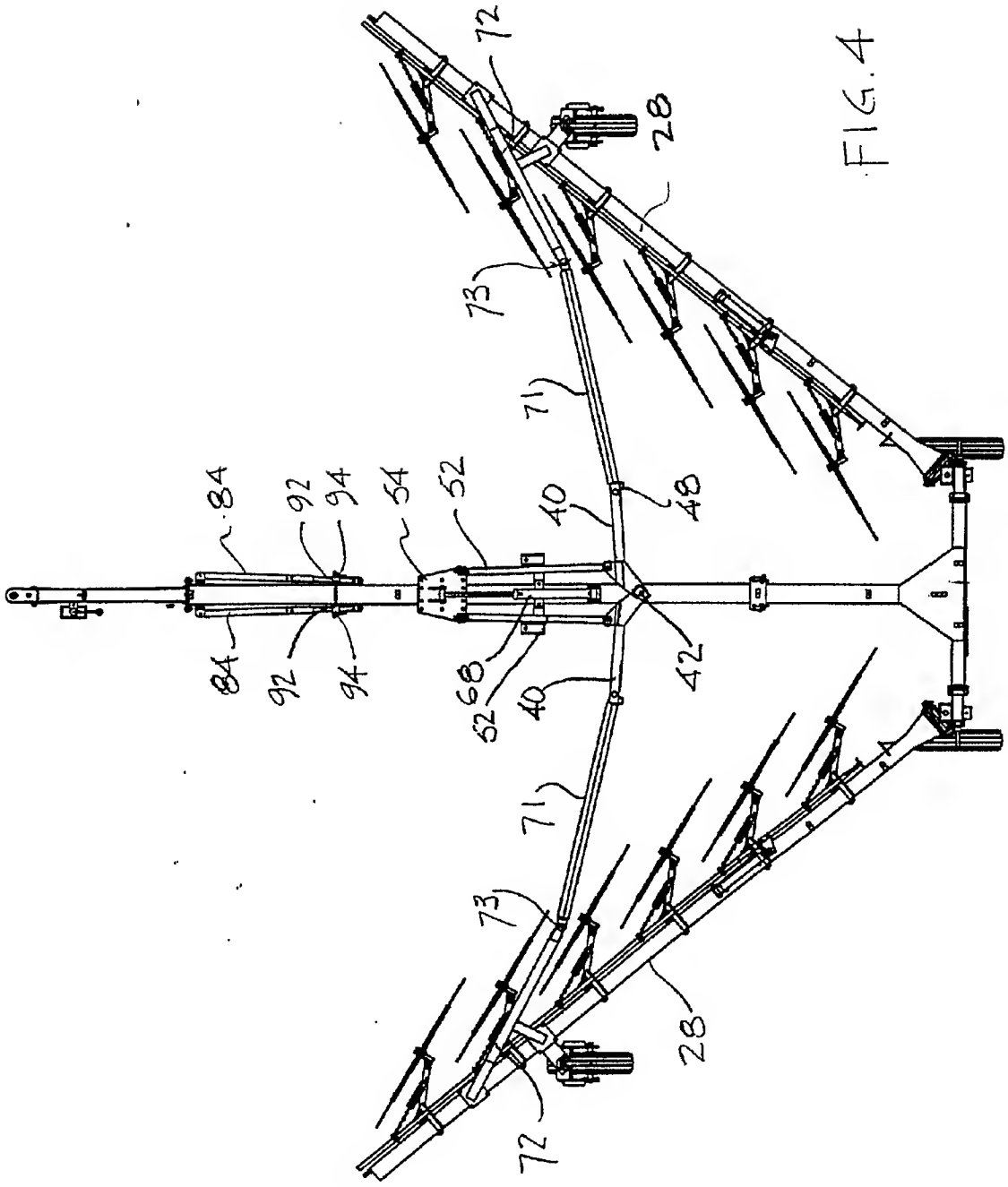


FIG. 4

INVENTOR: PAUL NADEAU

By: *ADE & COMPANY*

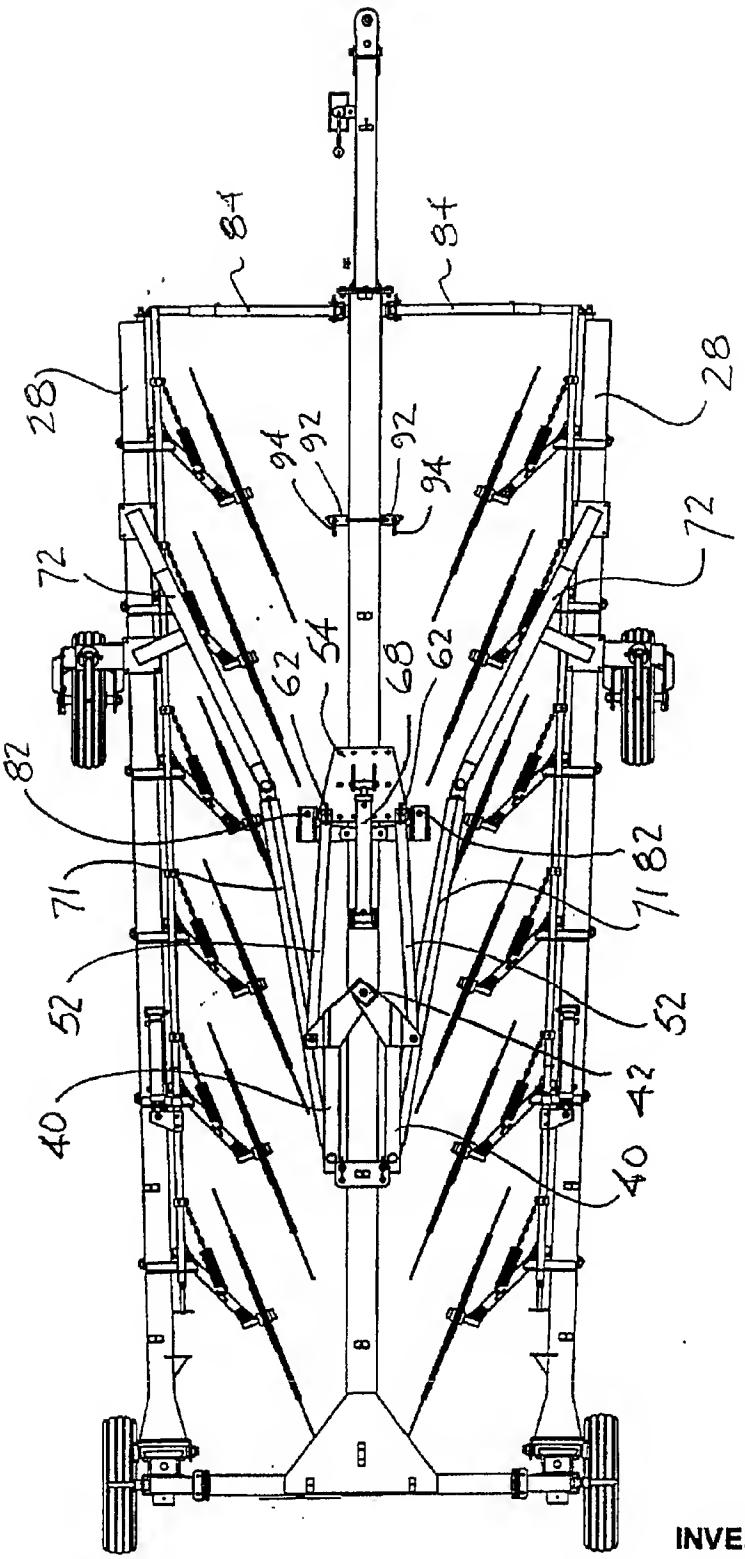


FIG. 5

INVENTOR: PAUL NADEAU
By: *ADE & COMPANY*

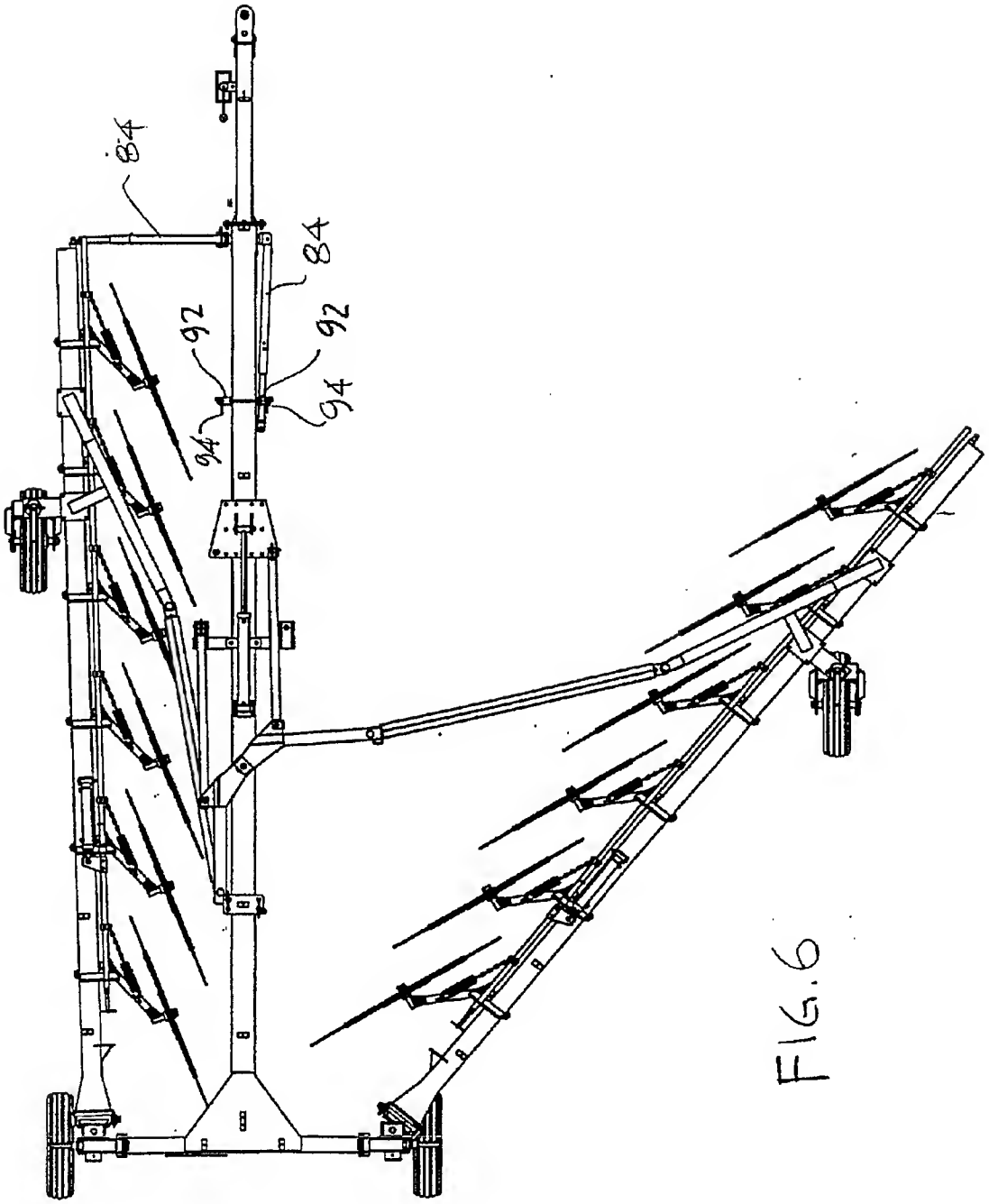


FIG.6

INVENTOR: PAUL NADEAU

By: *ADE & COMPANY*

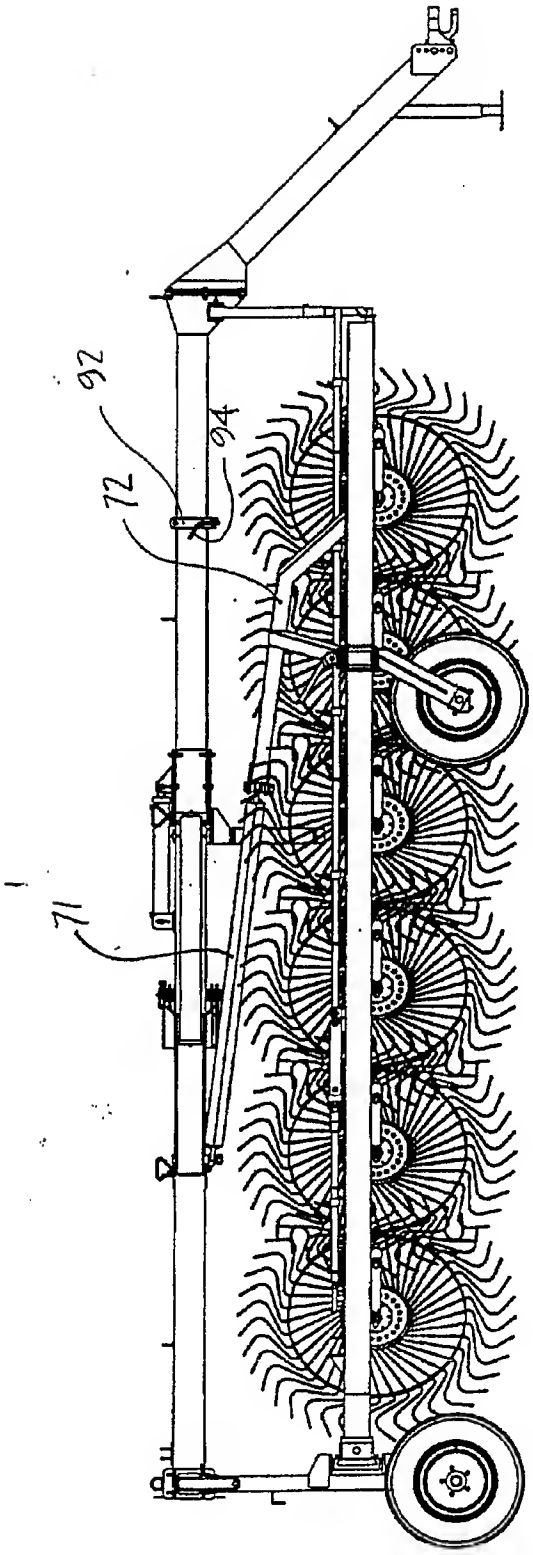


FIG. 7

INVENTOR: PAUL NADEAU
By: *ADE & COMPANY*

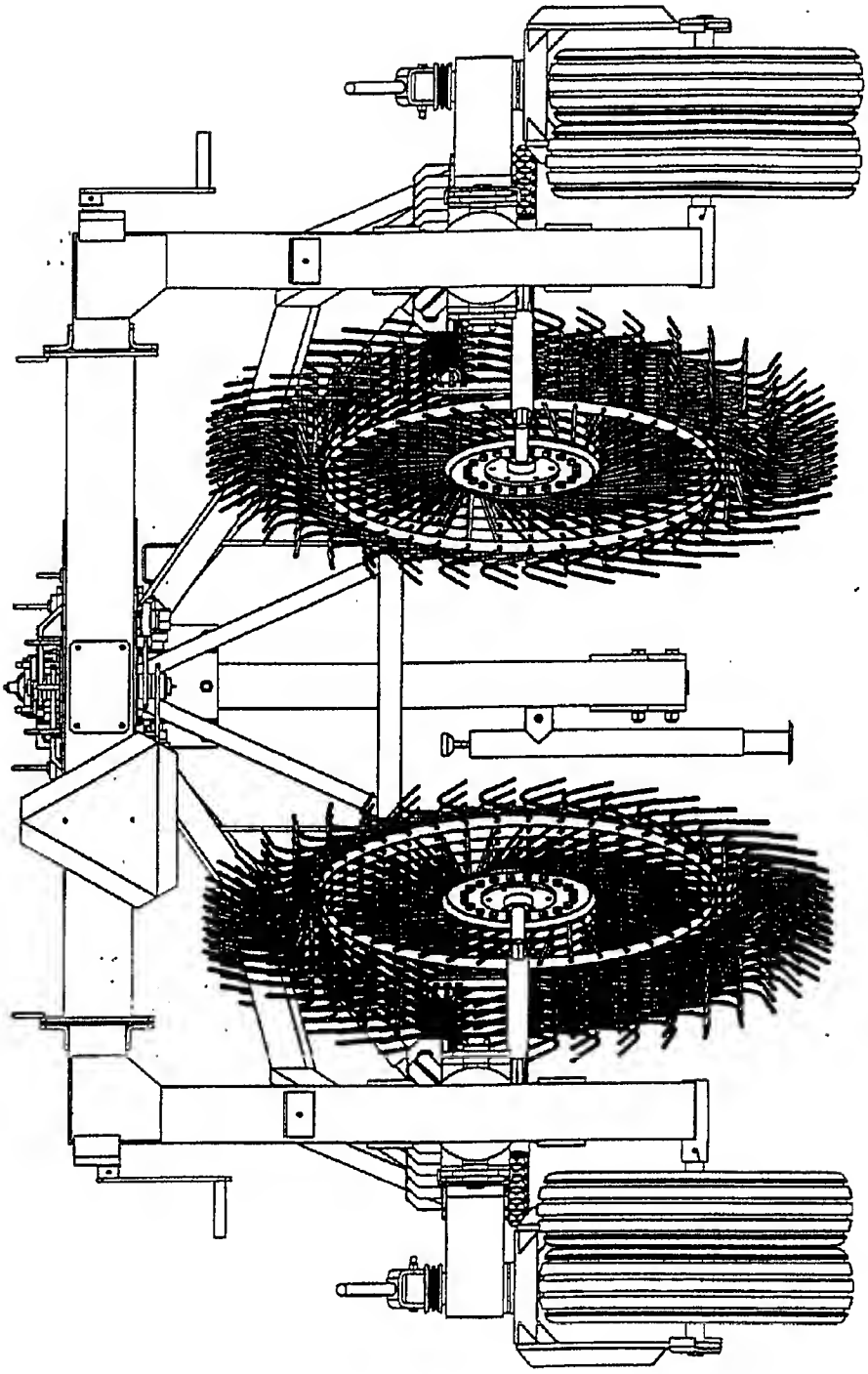


FIG.8

INVENTOR: PAUL NADEAU

By: *ADE & COMPANY*

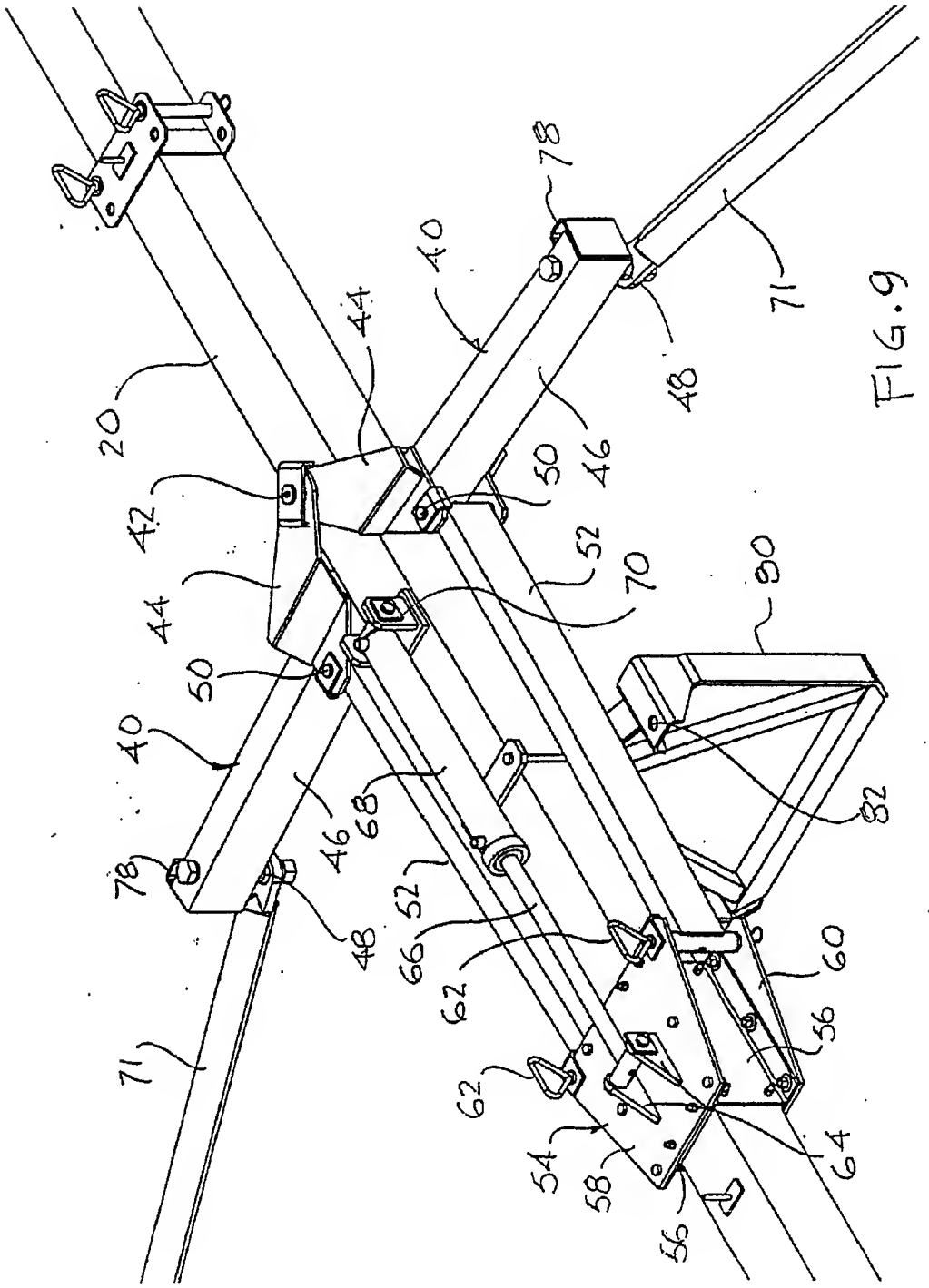


FIG. 9

INVENTOR: **PAUL NADEAU**

By: ***ADE & COMPANY***

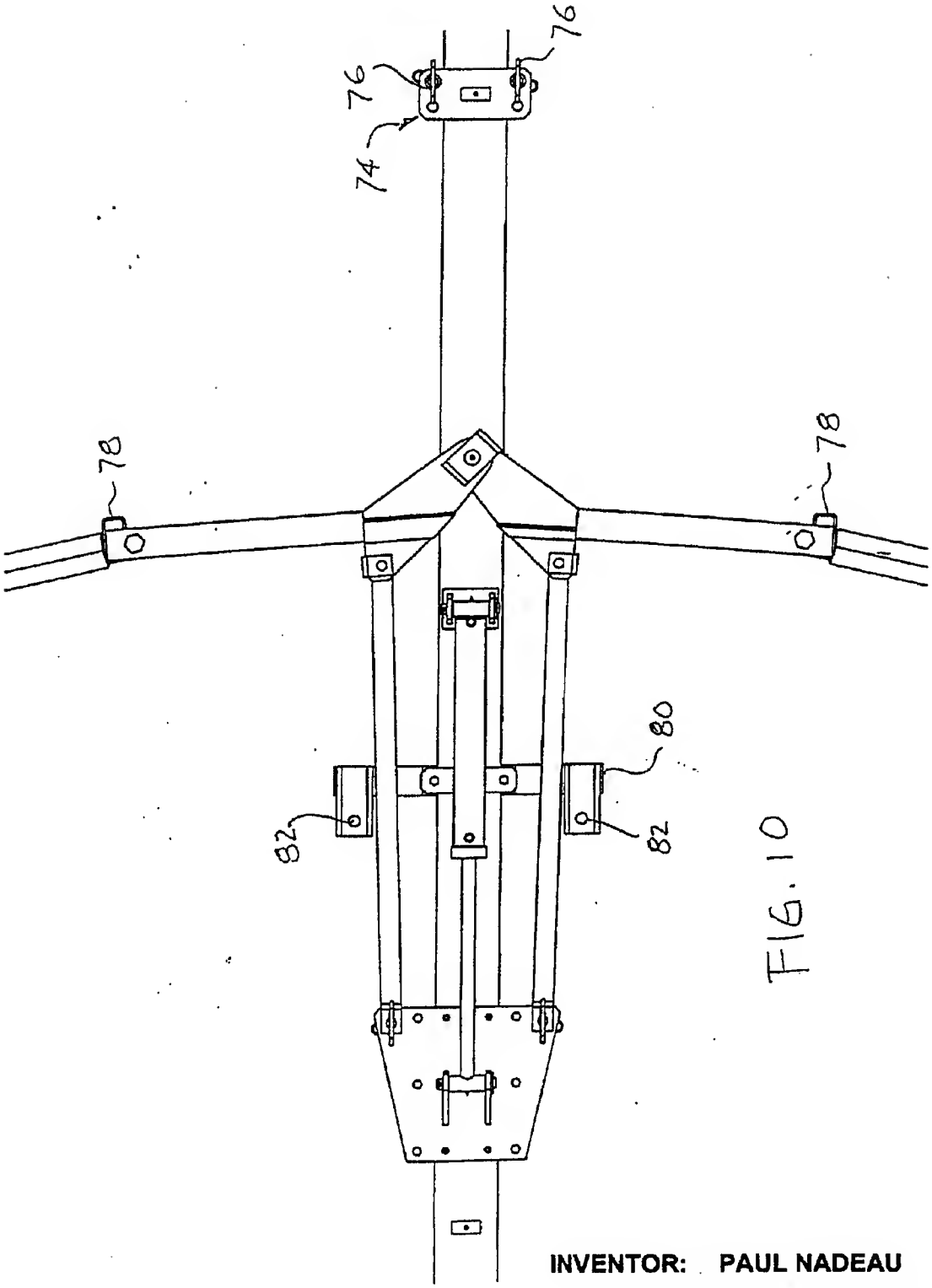


FIG. 10

INVENTOR: PAUL NADEAU
By: *ADE & COMPANY*

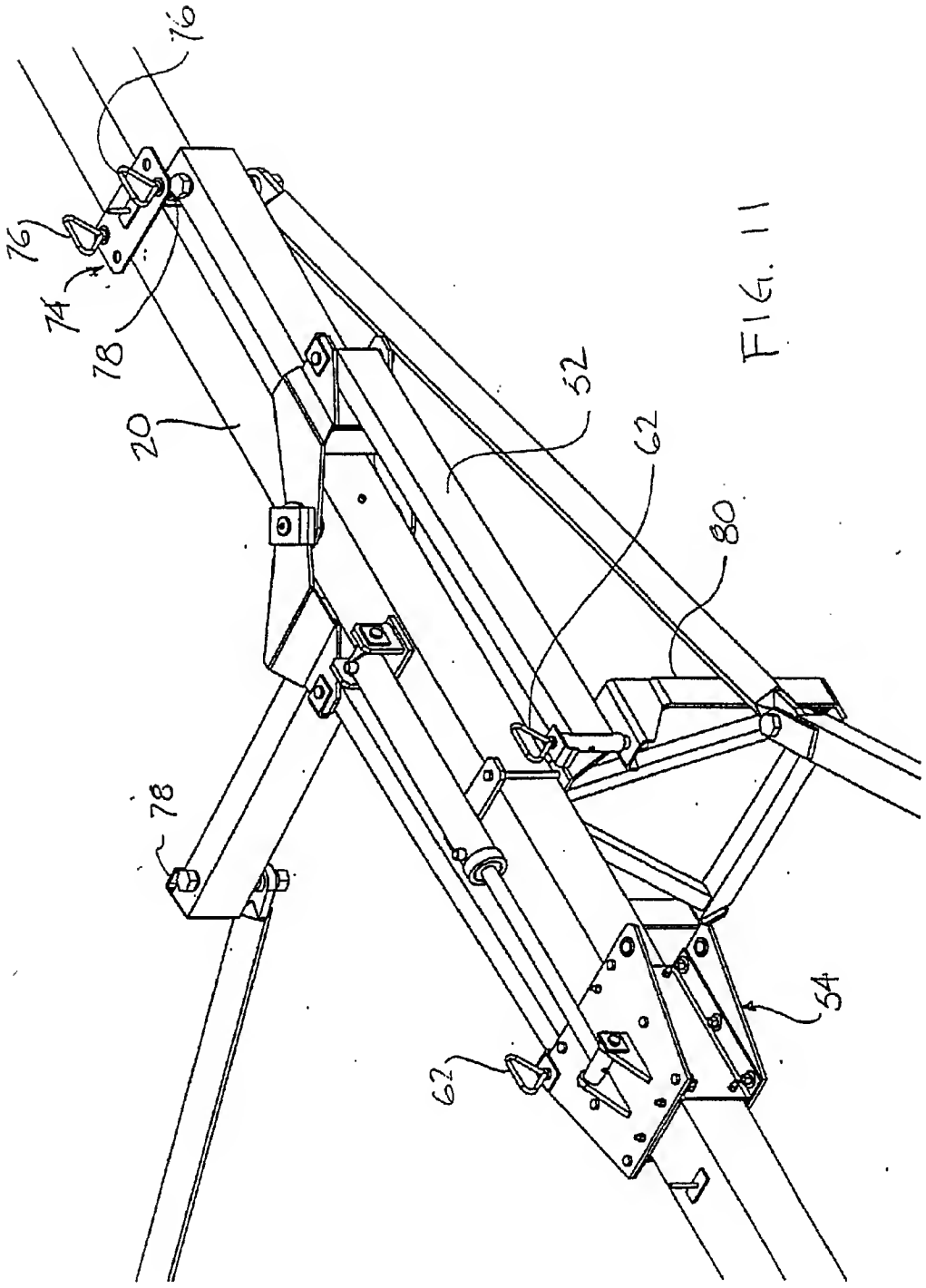


FIG. 11

INVENTOR: PAUL NADEAU

By: *ADE & COMPANY*

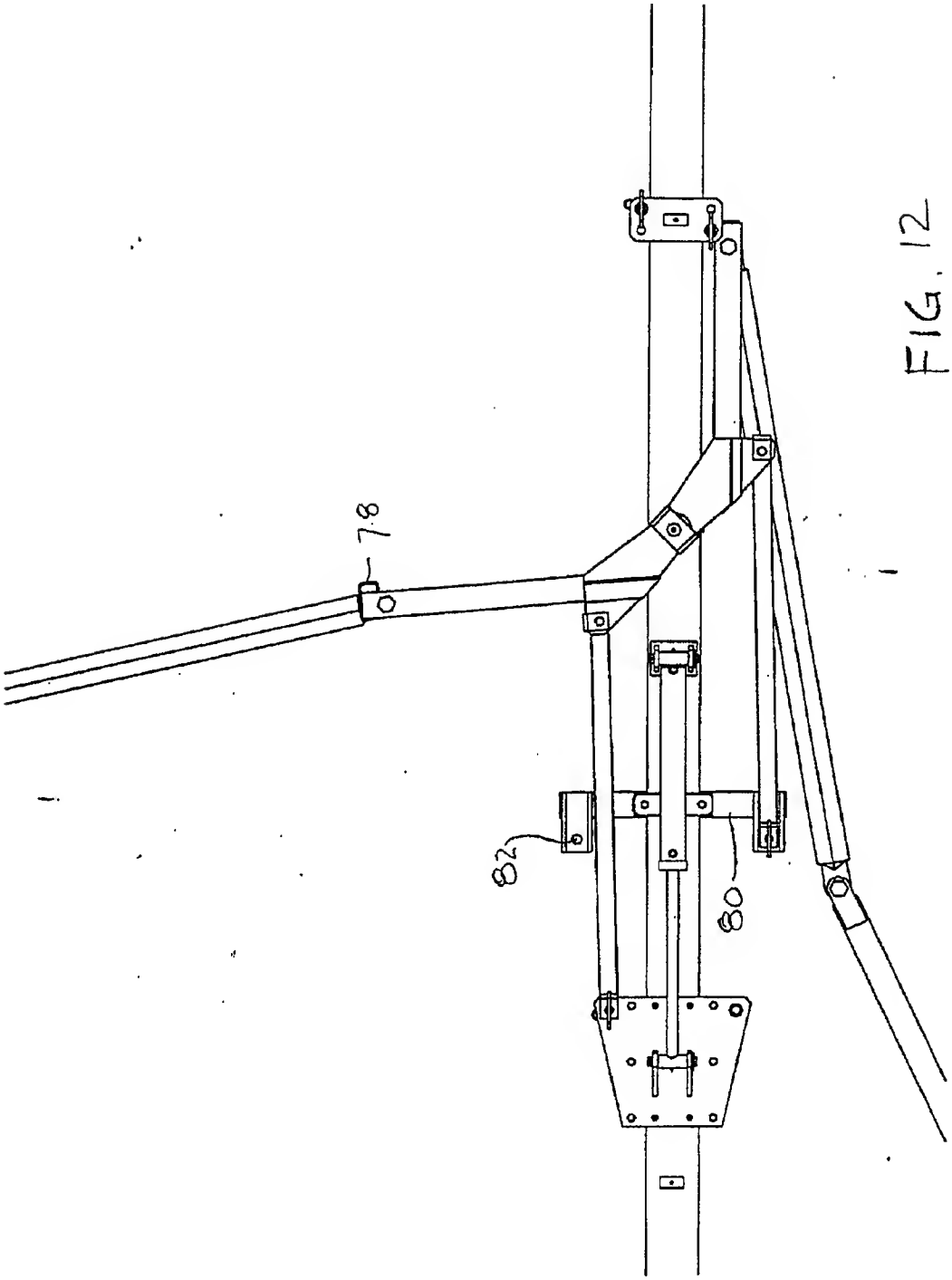


FIG. 12

INVENTOR: **PAUL NADEAU**
By: ***ADE & COMPANY***

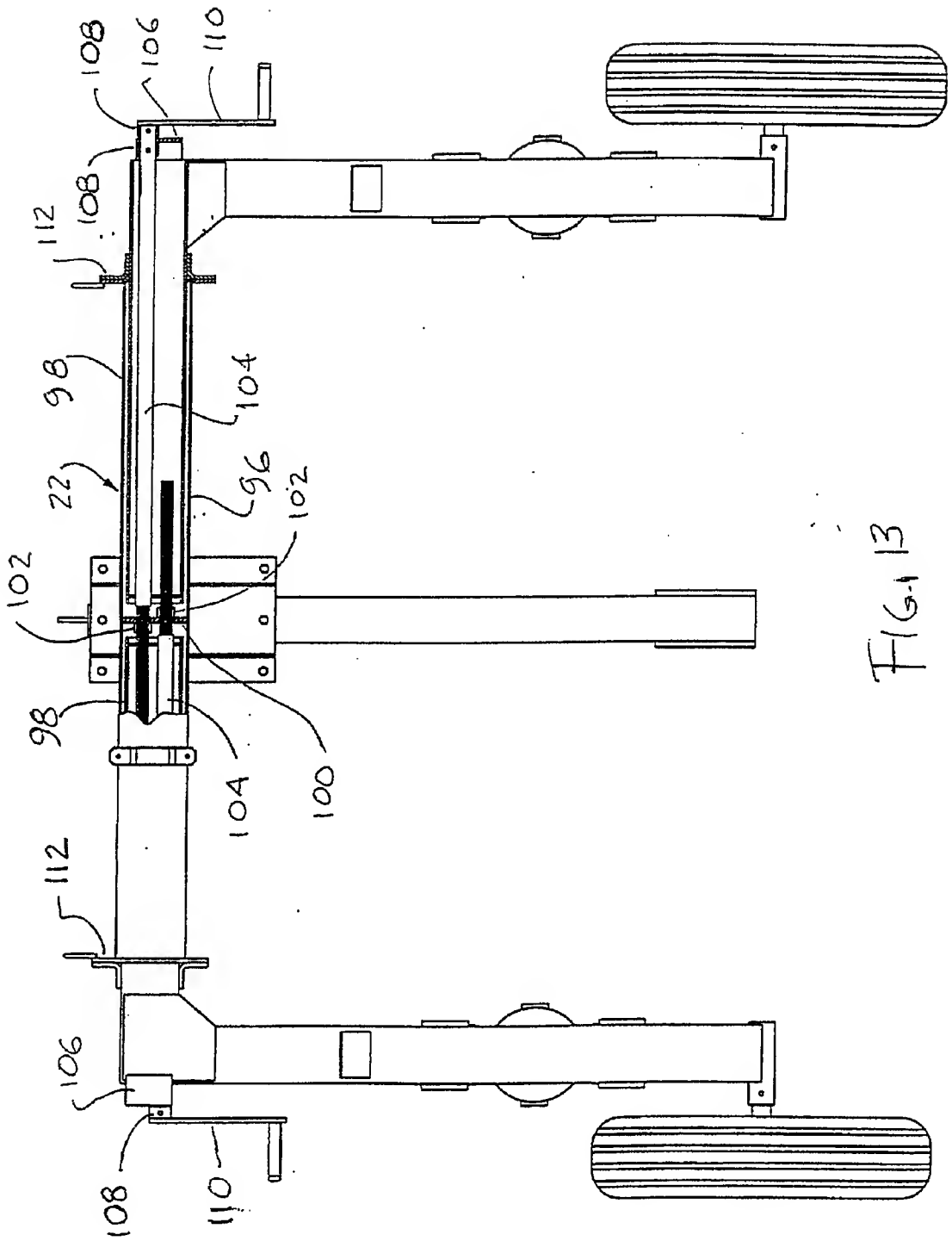


FIG. 13

INVENTOR: PAUL NADEAU

By: *ADE & COMPANY*

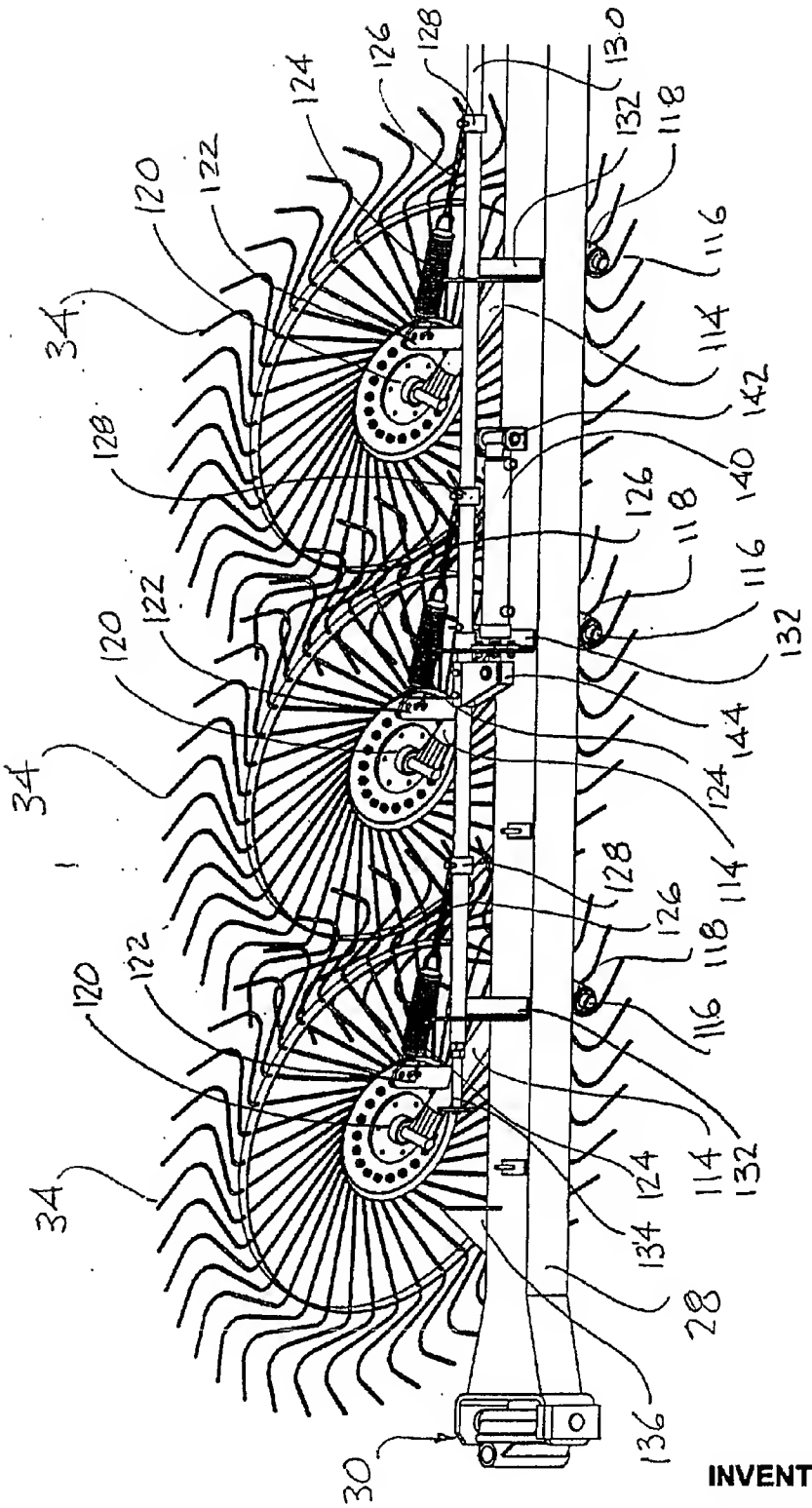


FIG. 14

INVENTOR: PAUL NADEAU
By: ADE & COMPANY